

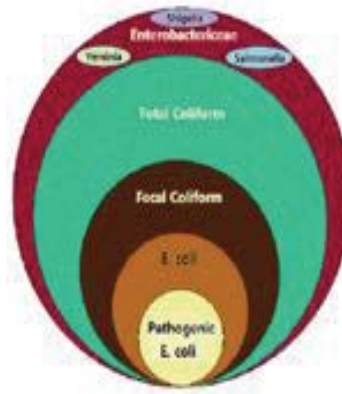
## Fecal Coliform

- A fecal coliform is a facultatively anaerobic, rod-shaped, gram-negative, non-sporulating bacterium. Coliform bacteria generally originate in the intestines of warm-blooded animals. Fecal coliforms are capable of growth in the presence of bile salts or similar surface agents, are oxidase negative, and produce acid and gas from lactose within 48 hours at  $44 \pm 0.5^{\circ}\text{C}$ .



## Fecal Coliform

- Indicator that disease organisms may also be present in the water
- Fecal coliform bacteria generally originate in the intestines of mammals.
- They have a relatively short life span
- Test is easy to perform and inexpensive.
- Their presence could be related to improper disposal of sanitary waste



## Why is Fecal Coliform a Problem

## Dermal Contact



### Thornton Creek Bacteria Study

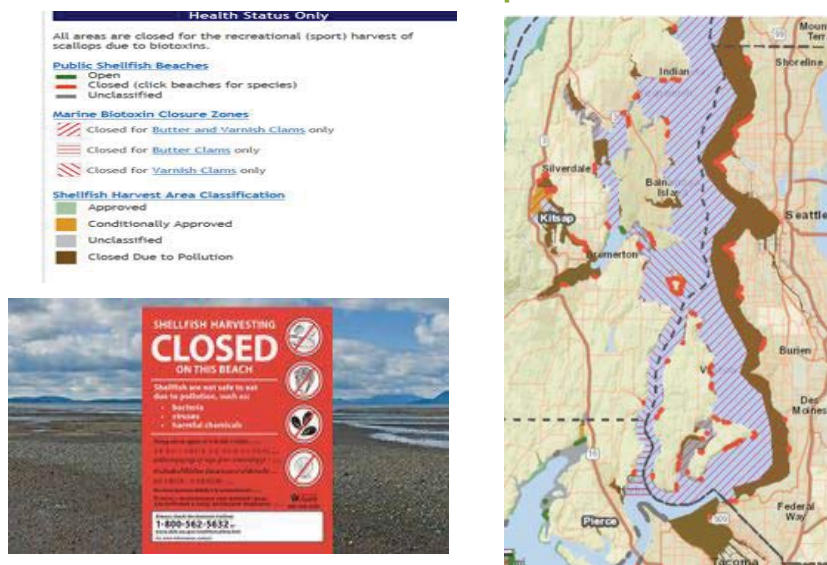
Public warned to stay out of Thornton Creek due to high bacteria levels; based on an intensive study done by the City of Seattle.

**We recommend avoiding contact with water from the following creeks due to high bacteria levels:**

John's Creek, Juanita Creek, Ravenna Creek, Idylwood Creek, and Thornton Creek.



## Consumption



## Environmental Impacts



Anoxia Chain



What is causing our bacteria pollution problems?



## Bacteria Sources: Wildfowl





## Bacteria Sources: Wild Animals



## Bacteria sources: Livestock



## Bacteria Sources: Domestics



## Get Out of The Water !!!



## Bacteria sources: humans



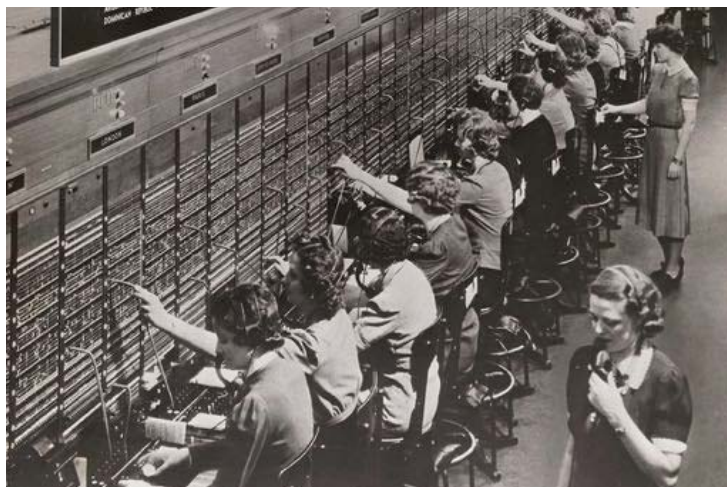
The most important source to control to protect human health

## Investigation Drivers

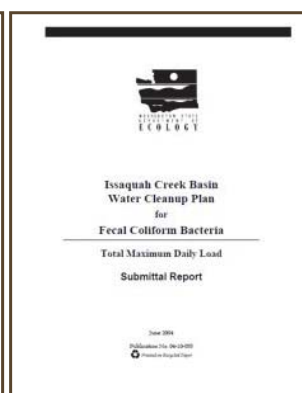
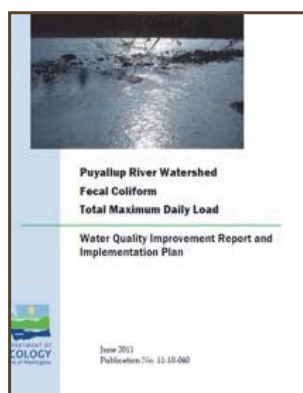




## Complaint Hotline



## Total Maximum Daily Load Programs



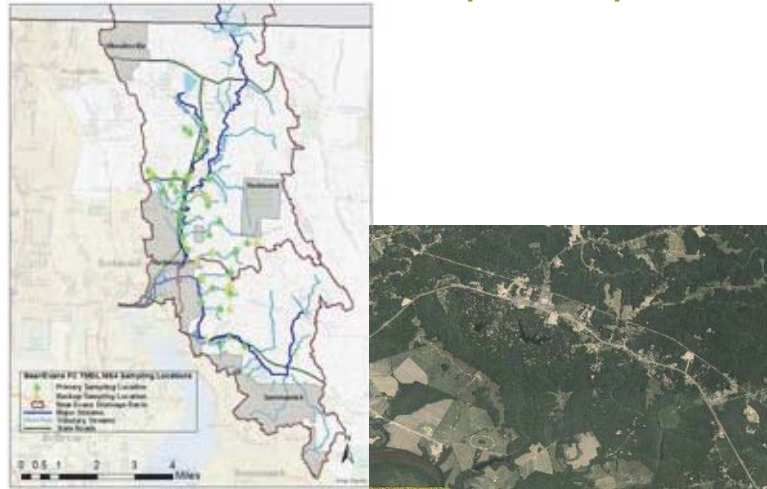
## Conveyance Screening Program



## Investigative methods



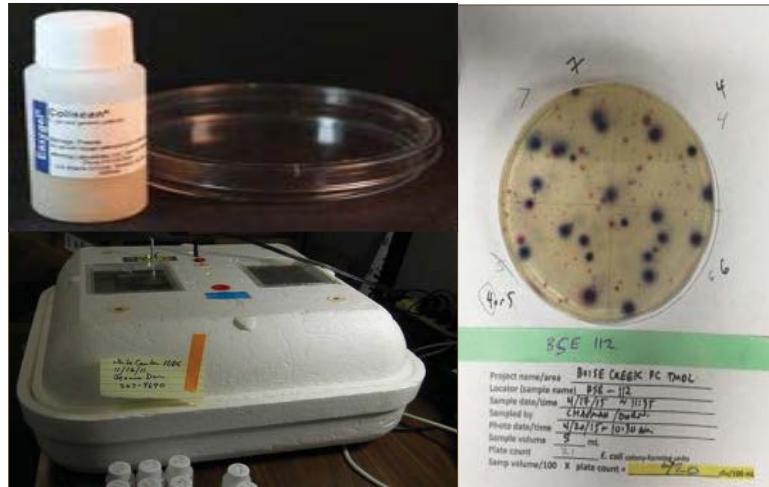
## Office/desktop analysis



## Field and Laboratory Methods

- Traditional
  - Culturing
  - Dye Testing
  - Optical Brighteners
  - Genetic Markers
- New
  - Multiprobes
  - Canine
  - Protein Markers
- Experimental
  - Flow sensors
  - Conservative organics
  - Rapid field tests for E. coli (MWK)

## Coliscan® Easygel®



## Dye testing, visible & rapid

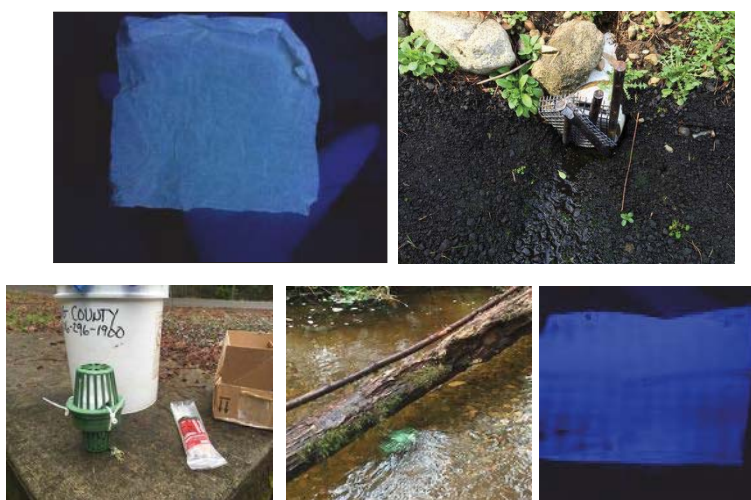




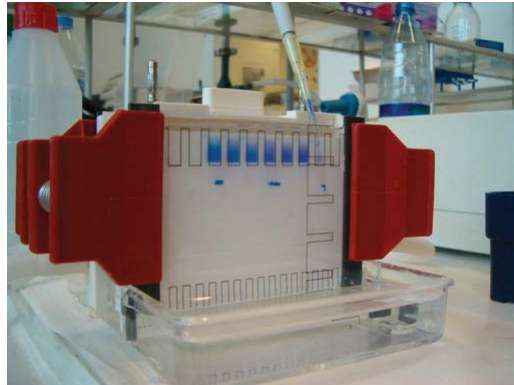
## Dye testing, charcoal packet



## Optical Brighteners



## MST/electrophoresis “library”

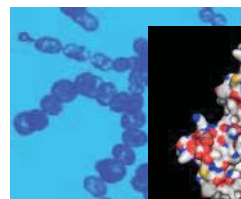
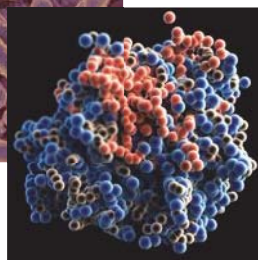


## MST/genetic markers

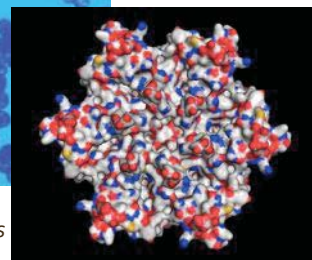
- Hu-1 and Hu-2-Bacteroides (qPCR DNA)
- Rum-2-Bacteroidales (qPCR DNA)
- Cow M2, Cow M3, and dog (now KCEL has)
- Gull, goat, and others available at private labs



Human  
*Bacteroides*



Cow  
*Bacteroidales*



## Multiprobes

- Ammonium & nitrate ions as possible indicators of pollution
- Specific conductivity, temperature also could be indicators



## Canine scent tracing

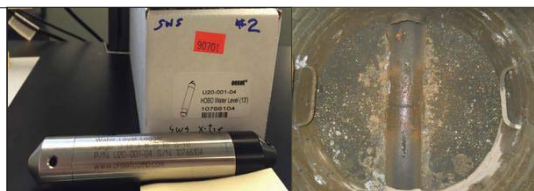


## Flow sensors



Jonathan Frodge, City of Seattle, deployed sensors in Thornton Creek, found illicit sewage discharge to creek.

King Co. is piloting water level /temp sensors in White Center closed conveyance.

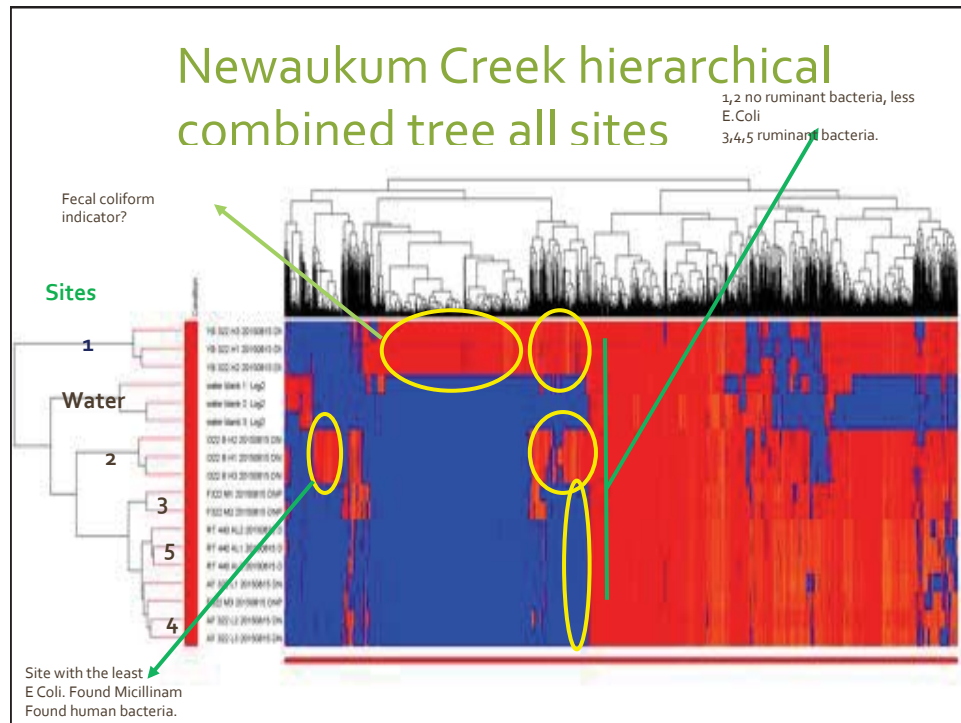


## Conservative organics

- Chemicals that get altered when passing through human body and don't readily break down; over 1400 compounds analyzed by Time-of-Flight Mass Spectrometry







## Rapid field tests for *E. coli* Mobile Water Kit



## Local Examples



## Overflow system



## How has SWS found problems?

- Lab results oriented:  
White Center  
high Bacteroides results led to  
dye testing -> two ICs found



- Field recon oriented:  
Boise Creek  
During field recon, IC dry weather trickle flow  
observed in old cb -> failing OSS found



## Staff labor time, equipment and lab costs



## Poverty Bay Down-grade



What are the “Four Pillars” of an OSS Program?

How do they help protect Water Quality?

